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Comparing car drivers' and motorcyclists' opinions about junction crashes

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A R T I C L E I N F O

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A B S T R A C T

Motorcyclists are involved in a disproportionate number of crashes given the distance they travel, with a high proportion of these crashes occurring at junctions. Despite car drivers being solely responsible for many road crashes involving a motorcycle, previous research has mostly focussed on understanding motorcyclists' attitudes towards their own safety.

We compared car drivers' (n = 102) and motorcyclists' (n = 579) opinions about junction crashes using a web-based questionnaire. Motorcyclists and car drivers were recruited in similar ways so that responses could be directly compared, accessing respondents through driver/rider forums and on social media. Car drivers' and motorcyclists' opinions were compared in relation to who they believe to be blameworthy in situations which varied in specificity, ranging from what road user they believe is most likely to cause a motorcyclist to have a road crash, to what road user is at fault in four specific scenarios involving a car and motorcycle at a junction. Two of these scenarios represented typical 'Right of way' (ROW) crashes with a motorcycle approaching from the left and right, and two scenarios involved a motorcycle overtaking another vehicle at the junction, known as 'Motorcycle Manoeuvrability Accidents' (MMA). Qualitative responses were analysed using LIWC software to detect objective differences in car drivers' and motorcyclists' language.

Car drivers' and motorcyclists' opinions about the blameworthiness of accidents changed depending on how specific the situation was that was being presented. When respondents were asked about the cause of motorcycle crashes in a general abstract sense, car drivers' and motorcyclists' responses significantly differed, with motorcyclists more likely to blame car drivers, demonstrating an in-group bias. However, this in-group favouritism was reduced when asked about specific scenarios, especially in MMA situations which involve motorcyclists manoeuvring their motorcycles around cars at a junction. In the four specific scenarios, car drivers were more likely to blame the car driver, and motorcyclists were more likely to blame the motorcyclist. In the typical ROW scenarios, the responses given by both road users, as analysed by the LIWC, show that the law is taken into account, as well as a large emphasis on the lack of observation given around junctions, especially from car drivers. It is concluded that the perception of blameworthiness in crashes is very much dependent on the details of the crash, with a more specific situation eliciting a fairer evaluation by both car drivers and motorcyclists.

1. Introduction

Research into road safety has increasingly focused on road users' attitudes, opinions, values and beliefs which are important in understanding how they perceive and accept different levels of risk on the road (O'Connell, 2002; Musselwhite et al., 2010). Despite this, there has been little research investigating road users' opinions towards common hazardous road situations, which could provide an important insight into why crashes occur. In the current paper, we are particularly interested in the opinions different types of road users (car drivers and motorcyclists) have towards the same road situations.

Motorcyclists represent a specific and important issue for road safety, as motorcyclists are involved in a remarkably high number of road crashes given the distance they travel (e.g. DfT, 2015a). Moreover, when they are involved in these crashes they are more likely than car drivers to be injured and killed in the crashes, with motorcyclists being typically referred to as one category of vulnerable road users (Shinar, 2012). The combined effect of frequency and severity is shown in crash statistics that reveal that in the U.K. motorcyclists in 2014 were involved in 122.3 fatalities per billion miles travelled compared with 1.8 fatalities per billion miles for car drivers (DfT, 2015a).

In the U.K., the most common motorcycle crash occurs at junctions, typically with another road user violating an oncoming motorcyclist's 'right of way' (ROW), by pulling out of a side junction onto a main carriageway (Clarke et al., 2007). In many of these instances it is a car that is pulling out into the junction. Afterwards the car driver often

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reports being careful and attentive with their visual checks but nonetheless having failed to see the approaching motorcycle. This is commonly termed the 'Look But Fail To See' error (Brown, 2002), and motorcycle riders have their own term for such events – 'SMIDSY' ("Sorry Mate I Didn't See You"). Although it is possible that the driver in these cases has failed to see an oncoming motorcyclist, it is also possible that they are sometimes deliberately claiming a failure in visual attention when another factor may be responsible for the crash. One possibility is that the car driver does not want to admit to a deliberate driving violation, such as accepting a risky gap between traffic. For this reason, research efforts have focussed on understanding motorcycle crashes at junctions by investigating both car drivers' gap acceptance behaviour around motorcycles (Keskinen et al., 1998; Mitsopoulos-Rubens and Lenné, 2012) and car drivers' visual attention towards motorcycles (Crundall et al., 2008a, 2012; Lee et al., 2015).

A framework used to understand car-motorcycle interactions was developed by Crundall et al. (2008b). This framework suggests that a top-down influence of car drivers' attitudes will determine how they will behave in a given situation. Road users' attitudes can include attitudes that concern themselves, other road users, or the environment. These attitudes can therefore guide car drivers' actions during car-motorcycle interactions on the road, and are thought to subsequently influence measurable cognitive strategies such as drivers' visual attention allocation. It must be noted that attitudes, opinions and values all have an interconnectedness, and are all powerfully shaped by our past history, group memberships, and by our context-dependent experience of the given moment (Bergman, 1998).

The majority of research focusing on attitudes has been used as an attempt to understand human behaviour (Ajzen and Fishbein, 1975) by investigating whether a person responds favourably or unfavourably to a given object. However, attitudes can be very variable and dependent on many aspects such as whether the object of thought is specific or intangible (Augoustinos and Walker, 1995). Attitudes have also been found to be very susceptible to the influence of context effects (Turner, 1985).

One of the classic biases found in human attitudes is that of in-group bias. More than 40 years of research has shown that people favour members of their own group in their opinions, attitudes, and behaviours (Ratner et al., 2014). In a road safety context, it may be that car drivers have more negative attitudes towards an outgroup, in this case motorcyclists, compared to their in-group, which would be fellow car drivers. A common example of this might be 'motorcyclists are risk takers' which is a misconception which many car drivers hold (Crundall et al., 2008b). Although such an attitude might be widely held among car drivers, motorcyclists are likely to have a much more finely nuanced understanding of their behaviour in risky situations. Of course, it is possible that if car drivers thought more specifically about the contexts in which motorcyclists accept risk, they might modify their attitudes. In many areas of social psychology, social judgements have been deemed to be context-dependent as they depend on the frame of reference in which they are made (Haslam et al., 1992), with in-group bias also being shown to be dependent on the context (Jost and Major, 2001).

Despite car drivers being solely at fault in many motorcycle accidents (ACEM, 2009), many previous studies have focussed on understanding motorcyclists' attitudes towards their own safety (Clarke et al., 2004; Musselwhite et al., 2012). Wong et al. (2010) conducted a large motorcycle study with 623 motorcyclists, with the aim to understand why young motorcyclists may be involved in a high number of collisions. They concluded that there were three important personality characteristics in young motorcyclists which were sensation seeking, amiability and impatience. The amiable riders were relatively mature and safe riders, whereas the sensation-seeking riders were more comfortable with unsafe riding, and interested in the utility gained from it.

Conversely, a research study by Crundall et al. (2008c) looked to identify potential gaps in car drivers' schemata in relation to motorcyclists that may account for their increased probability of being involved in a crash with a motorcycle. Drivers filled in a questionnaire which comprised of 26 general and motorcycle-related items and the 24 items of the reduced Driver Behaviour Questionnaire (Parker et al., 1995). It was found that when car drivers were compared to a dual driver group (drivers who also hold a motorcycle licence), they showed more negative attitudes towards motorcyclists and also self-reported more driving violations. This study is unusual in directly comparing car drivers' and motorcyclists' attitudes, although the motorcyclists in this study were also car drivers. The majority of comparison studies have focussed on comparing the two road users' behavioural responses in simulation tests (Horswill and Helman, 2003; Shahar et al., 2011) and natural on-road driving/riding (Walker et al. (2011).

Shahar et al. (2011) is the only study to have compared car drivers' and motorcyclists' opinions towards general hazardous situations as well as comparing them in a behavioural simulation task. Car drivers and motorcyclists were compared on the degree to which 9 vignettes of various hazardous road situations were reported to be realistic and dangerous. Half of the car drivers and half of the motorcyclists were told to imagine they were driving a car through the scenario and the other half were told to imagine they were riding a motorcycle. It was found that while the participants who were told to imagine riding a motorcycle rated the vignettes to be more realistic, the real-life motorcycle riders rated the scenarios more dangerous, suggesting that their specific motorcycle experience influenced their criterion for danger. Although this was one of the first studies to compare drivers' and motorcyclists' opinions, only one of the vignettes was specifically concerned with car-motorcycle junction crashes. In addition, in some instances, participants may have been asked to imagine situations which were very unrealistic, for example, asking a car driver to imagine riding a motorcycle. If the car driver had never ridden a motorcycle before, their opinions in this condition may not be useful as the participant has no previous relevant information to draw from. A previous meta-analysis has revealed that attitudes predict behaviour better when they rely on information relevant to a behavioural decision (Glasman and Albarracín, 2006).

The use of an online questionnaire which includes both quantitative and qualitative aspects can be beneficial in providing in-depth information on road users' opinions which may guide these behaviours. Therefore, the current study's main purpose was to compare the opinions of car drivers and motorcyclists towards crashes at junctions, in particular, crashes that specifically occur with a car driver and a motorcyclist. This is the first research study to ask both car drivers and motorcyclists their opinions on the most common accidents that occur between these two road users, therefore although it may be assumed that, in general, road users blame the other road user for the crash, this has not been directly tested. By identifying and comparing the opinions of car drivers and motorcyclists, this may clarify the beliefs about nature and blameworthiness of these crashes, and therefore have important implications for road safety in terms of guiding researchers and policy makers to suggest new practical applications and interventions. Car drivers' and motorcyclists' opinions are important in regards to the framing and acceptability of road safety interventions, with these opinions influencing their engagement in such interventions.

In light of the previous research, we would expect to find evidence for in-group biases for abstract questions such as "what road user is most likely to cause a motorcyclist to have a road accident", or "what road user is most likely to be to blame for car-motorcycle junction accidents". In contrast, we would predict that if more scenario-specific information is provided for an example of a crash in a particular context, the degree of in-group bias should be reduced and car drivers' opinions about motorcyclists should be found to be more balanced.

1.1. The selection of scenarios

The specific scenarios which were presented to car drivers and motorcyclists in the online questionnaire were chosen from a

Table 1
Shows the for main types of motorcycle crash and their frequencies found in a review conducted in the U.K. by Clarke et al. (2004).

Type of Crash	Percentage of Motorcycle crashes in Sample (n = 1790)
Right of Way Crashes (ROW)	38% (n = 681)
Losing control on Bends	15% (n = 268)
Motorcycle Manoeuvrability Accidents (MMA)	17% (n = 304)
Other motorcycle crashes	30% (n = 537)

motorcycle review conducted in the U.K. by Clarke at al. (2004). The review involved the analysis of over a thousand real world crash cases, and questionnaire responses from over 100 experienced motorcyclists. Motorcycle crashes were divided into 4 categories which can been seen in Table 1 along with their frequencies.

The four categories of motorcycle crash, as found by Clarke et al., (2004), are explained below. Right of way (ROW) crashes are by far the most common motorcycle crash in the UK, being three times more likely to occur at junctions than any other road situation (Hole and Langham, 1997). Clarke et al. (2004) found that in over 65% of ROW crashes, these were typical 'look but fail to see' instances as described above where the driver reports failing to see an oncoming motorcycle and pulls out into its path (Brown, 2002). This review also reported that such crashes are more likely to be considered as the car driver's fault. In contrast, when a motorcyclist loses control on a bend, previous studies have found that this crash is usually a result of over braking, speeding or cutting the corner, with most road users accepting that such crashes are the fault of the motorcyclist (Hurt et al., 1981). According to Clarke et al. (2004), this crash is believed to be related to inexperience in riding a motorcycle, with the main emphasis on the loss of vehicle control rather than a cognitive error. The third category, Motorcycle Manoeuvrability Accidents (MMA) provides a more mixed picture. This can include many types of crash which have in common the fact that motorcyclists can manoeuvre their bikes in ways which are not available to larger vehicles. In the majority of these crashes, motorcyclists overtake another vehicle, which subsequently causes a crash. In these instances, the other driver is more than twice as likely to be considered at fault for the crash compared to the motorcyclist involved, though there is also evidence for an increased proportion of 'combined fault' accidents in this category (Clarke et al., 2004). The road user considered to be at fault for each crash type in Clarke et al. (2004) was based upon police accident files, which included a brief accident story as interpreted by the attending police officer. For the current study, we were particularly interested in exploring car drivers' opinions in cases where they are likely to be at fault (e.g. ROW Accidents) and situations where blame is harder to define, but where there is a high likelihood that the car driver was at least partly at fault (MMA).

ROW crashes have also been seen to be the most prevalent motorcycle crash in the U.S., with an analysis of 900 motorcycle crashes revealing that 75% involved another vehicle violating the ROW of the motorcycle at an intersection, usually by turning left in front of the oncoming motorcycle (Hurt et al., 1981). A comparison of motorcycle crashes from Malaysia, Taiwan and Vietnam also found that non-signalised intersections were one of the most hazardous locations for motorcycle crashes as well as crashes involving a motorcycle overtaking or filtering other traffic (Hsu et al., 2003).

In light of this, the scenarios given in our questionnaire reflect the most common junction crashes that occur with cars and motorcycles. Two scenarios which represent typical ROW crashes were given, with the blame commonly given to the car driver in these instances. Both of these scenarios included a car driver waiting at a junction to turn right, with a motorcycle approaching from the right in the first instance and the left on the second instance. Since our participants were U.K. drivers/riders all scenarios have driving/riding taking place on the left-hand side of the road. The next two scenarios were chosen to represent MMA and included two common crashes which involve motorcyclists overtaking other vehicles near a junction. The first common MMA occurs when a driver is waiting to pull out of a junction however, the visibility of an oncoming motorcycle is reduced due to them overtaking a slower vehicle approaching the junction. The second MMA is when a driver is waiting to turn right into a junction while a motorcycle is overtaking them. These 4 scenarios were selected as they are the most common crashes involving both a car driver and motorcyclist at an intersection and provide the opportunity for debate on who is at fault in these situations (Clarke et al., 2004).

2. Methods

2.1. The questionnaires

Our goal in the current study was to recruit motorcyclists and car drivers in similar ways, with them both being recruited through UK driving/riding forums and online. Respondents recruited via forums, both motorcyclists and car drivers, are likely to have an affinity towards that mode of transport, therefore respondents could be directly compared. In order to obtain a sufficient sample size, we chose to use a web-based questionnaire. We advertised these questionnaires on car driving forums which included the RAC Driving Forum, Advanced Driving Forum and The Car Expert Forum, and on motorcycle forums which included the RAC Motorcycle Forum, Advanced Motorcycle Forum and The Motorbike Forum. To increase the sample size, we additionally advertised the questionnaires on social media.

There were two linked questionnaires, one for car drivers and one for motorcyclists. Both of the questionnaires consisted of seven main sections, which in general had an identical format with the exception of slight changes in the wording to make it more comprehensible and relevant to the audience.

The first two sections asked participants for personal details such as age, gender and recruitment details, as well as details about their driving/riding experience in terms of training, mileage and main purpose of transport. These two sections were mainly included for respondent demographic purposes.

This was then followed by three on-road safety sections, with the first concerned with respondents' opinions about vulnerable road users in general, and any personal or family member road accidents. Family/friend road accidents were investigated, as previous research shows that road users who have family or close friends that ride motorcycles are less likely to collide with motorcyclists (Brooks and Guppy, 1990). The second on-road safety section was more specifically concerned with motorcycle crashes, asking respondents who they believe who is more likely to cause a motorcyclist to have a crash, what people believe to be the most common motorcycle crash, and whether the road is seen to be a shared or competitive space. The last on-road safety section was specifically concerned with who they believe is most to blame for junction crashes that involve a car and a motorcycle.

The next two sections contained four scenarios which reflect the most common car-motorcycle junction crashes as reviewed in Clarke et al. (2004). These four common motorcycle junction crashes were displayed to participants in the form of a diagram, where they had to choose what road user would be most at fault in the situation if a crash was to occur and explain why, see Fig. 1.

The final section included two optional open questions, giving respondents an opportunity to express any other opinions regarding junction crashes involving motorcycles. The main questions of interest and the possible responses for both the questionnaires are reported in Table 2.

2.2. The Linguistic Inquiry and Word Count (LIWC)

A quantitative analysis of the data was conducted, with the addition of the Linguistic Inquiry and Word Count (LIWC) to analyse the

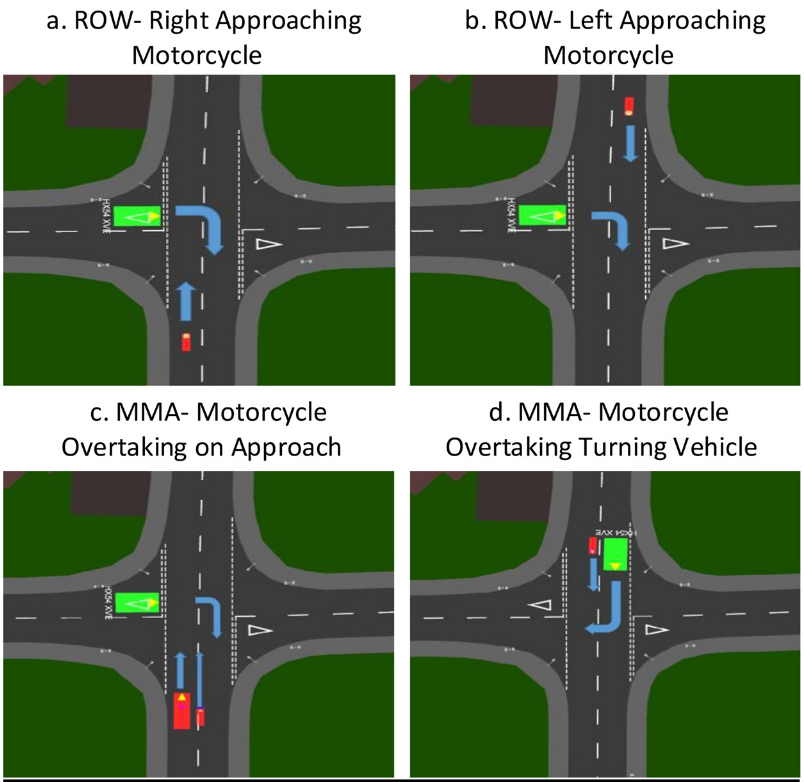

Fig. 1. The four situations shown to participants in the questionnaire. Respondents had to decide whether the green car or the red motorcycle would be at fault in these situations, if a crash were to occur. 1a and 1b were intended to represent standard situations typical of ROW (Right of Way) crash with a motorcycle approaching from the left and right, while 1c and 1d represent MMA (Motorcycle Manoeuvrability Accidents) involving a motorcycle overtaking another vehicle at the junction. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

qualitative responses the respondents gave. The LIWC was used as a formal way of presenting data, to extend the previous qualitative presentation of motorcyclists' motivations and opinions in the literature (Christmas et al., 2009).

The LIWC analyses the contents of text files and calculates the percentage of words that fall within a series of dictionary dimensions and linguistic categories (Tausczik and Pennebaker, 2010). The program has different dimensions such as summary language variables and psychological constructs (Pennebaker et al., 2015). The LIWC has been used in a large body of research with psychological constructs, for example, being established as a valid measure of understanding behaviour (Cohn et al., 2004). This indicates that quantitative methods can be effective in analysing the linguistic and emotional contents of text.

2.3. Analysis

All quantitative questionnaire responses for both car drivers and motorcyclists were subject to a non-parametric chi-square test of goodness-of-fit. This analysis was conducted to determine whether there was a relationship between group (car drivers vs. motorcyclists) and the response given to the question. Chi-squared tests were performed on questions with forced choice responses, where the respondent could only choose one answer. The possible responses that could have been given by car drivers and motorcyclists were identical on both questionnaires. In order to ensure that the assumptions for Chi-squared analyses were met, response options with very low frequencies were removed from the analysis. In addition, for selected questions, only certain responses were analysed. The responses marked with a (*) in Table 2 show responses to each question that were not analysed due to making the analysis more focussed, with the main hypotheses investigating whether car drivers and motorcyclists are more likely to blame their in-group or out-group depending on the situation presented. The responses marked with a (**) in Table 2 show the responses that were not included in the subsequent analysis due to low frequencies.

The chi-squared tests compared the primary identification of the respondents (car drivers vs. motorcyclists), by which questionnaire they chose to fill out. It was noted however, that some respondents may also be dual road users (drive a car and ride a motorcycle). Multinomial logistic regressions were performed to model the relationship between five key predictors and attribution of blame for abstract questions and four specific scenarios questions, with one of the predictors dividing the respondents down further into car drivers, motorcyclists and dual road users (drive a car and ride a motorcycle). The five predictors were gender, age, road user type (car drivers, dual road users and motorcyclists), personal accident and family/friend accident, and the attribution of blame was either car driver, motorcyclist or both. No violations of goodness of fit were found in overall Pearson chi-square statistics. As there are three possible values of the outcome variable, the reference group for all models was blaming the car driver. Although we did not correct for multiple comparisons, we report the statistics in Tables 3–5, indicating significance at $p < 0.5$, $p < 0.01$ and $p < 0.001$ and the test statistics.

All qualitative questionnaire responses were processed using the LIWC. Any linguistic dimensions or psychological categories where less than half of the participants had produced a response were removed from analysis. Although LIWC can calculate more than 90 separate linguistic variables from text, for the purposes of our research only summary language variables and words associated with psychological processes believed to be relevant to driving were selected, which included words related to affective, cognitive, perceptual and motivational (drive) processes. These psychological constructs were selected as they have been previously established as valid in understanding behaviour, with emotional language changing according to situational valence (Eid et al., 2005), and cognitive language related to traumatic events (Cohn et al., 2004), all of which are relevant to driving. Although it is possible within LIWC to break down the data further, the sub-categories within these psychological processes did not have over half of the participants producing a response. For example, cognitive processes could not be broken down into the sub-categories of 'insight', 'causation', 'discrepancy', 'tentative', 'certainty' and 'differentiation' and therefore had to be analysed under overall cognitive processes. In

Table 2
Shows the questions used in both questionnaires and the possible responses the respondents could have given to each question. Responses marked with a (*) indicate the responses that were not included in the subsequent analysis due to making the analysis more focussed, and responses marked with a (**) indicate responses that were not included in the subsequent analysis due to low frequencies- See Section 2.3 for the analysis.

Question	Possible Responses				
Transport Purpose- What is your main reason for using a car/motorcycle?	Commuting	As part of your job	Leisure	Personal	Other
Vulnerable Road User- What mode of transport do you consider to be most vulnerable on the road?	Car**	Motorcycle	Large Vehicle**	Bicycle	
Personal Accident- Have you ever been involved in an accident with another road user that has resulted in injury?	Yes	No			
Family/Friend Own Motorcycle- Does anyone in your immediate family/close friends own a motorcycle?	Yes	No			
Family/Friend Accident- Have any of your immediate family members/close friends been involved in a motorcycle accident that has resulted in injury?	Yes	No			
Cause- What road user do you think would most likely cause a motorcyclist to have a road accident?	Motorcyclists themselves	Car Drivers	Large Commercial Vehicles**	Cyclists* *	Other**
Accident Type- What do you think is the most common accident type for a motorcyclist to be involved in?	Collision while overtaking road users	Being hit from behind	Collisions with right turning vehicles	Collisions with left turning vehicles	Loss of control by a motorcyclist
Shared/Competitive - Do you believe the road to be a shared or competitive space with motorcycles?	Shared	Competitive			
Blame- The majority of accidents involving motorcycles occur at junctions. Who do you think is mostly to blame for car-motorcycle junction accidents?	Motorcyclists	Car Drivers	Both Car Driver and Motorcyclist*	Neither*	
ROW- Right Approaching Motorcycle- Who do you think would be most at fault in this situation, if an accident was to occur?	Car Drivers	Motorcyclists	Both Car Driver and Motorcyclist*	Neither*	
ROW- Left Approaching Motorcycle- Who do you think would be most at fault in this situation, if an accident was to occur?	Car Drivers	Motorcyclists	Both Car Driver and Motorcyclist*	Neither*	
MMA- Motorcycle Overtaking on Approach - Who do you think would be most at fault in this situation, if an accident was to occur?	Car Drivers	Motorcyclists	Both Car Driver and Motorcyclist*	Neither*	
MMA- Motorcycle Overtaking Turning Vehicle - Who do you think would be most at fault in this situation, if an accident was to occur?	Car Drivers	Motorcyclists	Both Car Driver and Motorcyclist*	Neither*	

Table 3
Shows the results for the Chi Squared conducted for the Cause and Blame questions as well as the ROW and MMA scenarios. The first Chi-square conducted for each question was the main analysis comparing car drivers' and motorcyclists' responses. The following Chi-squares show the gender split. Each Chi-square shows the percentage for each group, and whether there was a group difference. Below each Chi-square is the probability associated with the test.

		Car Drivers	Motorcyclists		Male Car Drivers	Female Car Drivers		Male Motorcyclists	Female Motorcyclists		Male Car Drivers vs Male Motorcyclists	Female Car Drivers vs Female Motorcyclists
	Full n	102	579		55	47		505	74			
Cause- What road user do you think would most likely cause a motorcyclist to have a road accident?	**n for question**	83	557	640	46	37	83	483	74	557	529	111
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Car Drivers	57.8	74.5	**10.04**	60.9	54.1	.39	73.9	78.4	.67	3.61	**6.99**
	Motorcyclists	42.1	25.5	**.01****	39.1	45.9	.53	26.1	21.6	.41	.06	**.01****
Blame- The majority of accidents involving motorcycles occur at junctions. Who do you think is mostly to blame for car-motorcycle junction accidents?	**n for question**	45	304	346	26	19	45	270	34	304	296	53
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Car Drivers	97.8	95.7	.43	100	94.7	1.4	95.6	97.1	.17	1.2	.18
	Motorcyclists	2.2	4.3	.51	0.0	5.3	.24	4.4	2.9	.68	.27	.67
ROW- Right Approaching Motorcycle- Who do you think would be most at fault in this situation, if an accident was to occur?	**n for question**	98	521	619	52	46	98	457	64	521	509	110
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Car Drivers	98.9	98.8	.01	98.1	100	.89	98.7	100	.85	.13	–
	Motorcyclists	1.1	1.2	.91	1.9	0.0	.34	1.3	0.0	.36	.72	–
ROW- Left Approaching Motorcycle- Who do you think would be most at fault in this situation, if an accident was to occur?	**n for question**	95	506	601	52	43	95	445	61	506	497	104
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Car Drivers	92.6	96.4	2.91	90.4	95.3	.85	96.4	93.4	1.82	**5.3**	2.71
	Motorcyclists	7.4	3.6	.08	9.6	4.7	.36	3.1	6.6	.18	**.05***	.1
MMA- Motorcycle Overtaking on Approach - Who do you think would be most at fault in this situation, if an accident was to occur?	**n for question**	61	376	437	30	31	61	333	43	376	363	74
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Car Drivers	37.7	22.6	**6.43**	33.3	41.9	.48	23.4	16.3	1.11	1.47	**6.01**
	Motorcyclists	62.3	77.4	**.01****	66.7	58.1	.49	76.6	83.7	.29	.23	**.05***
MMA- Motorcycle Overtaking Turning Vehicle - Who do you think would be most at fault in this situation, if an accident was to occur?	**n for question**	78	454	532	42	36	78	393	61	454	435	97
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Car Drivers	10.3	4.4	**4.57**	7.1	13.9	.96	4.6	3.3	.21	.54	**3.81**
	Motorcyclists	89.7	95.6	**.05***	92.9	86.1	.33	95.4	95.6	.65	.46	**.05***

$^{*}p < .05$; $^{**}p < .01$.

Table 4
Shows the results for the Multinomial logistic regression for Cause and Blame questions as well as the ROW and MMA scenarios. The first table indicates the contribution each predictor had to the overall model. χ^2 = amount by which -2 log likelihood increases when predictor is removed from full model. *df* = degrees of freedom. The second table compares the reference category outcome response (car driver), with the other two outcome responses (motorcyclist and both) for each predictor variable. B = unstandardized coefficients. OR = Odds ratio associated with the effect of a one standard deviation increase in the predictor.

Model Contributions	Cause			Blame			ROW- Right Approaching Motorcycle			ROW- Left Approaching Motorcycle			MMA- Motorcycle Overtaking on Approach			MMA-Motorcycle Overtaking Turning Vehicle		
Predictor	χ^2	*df*	*p*	χ^2	*df*	*p*	χ^2	*df*	*p*	$^2\chi$	*df*	*p*	χ^2	*df*	*p*	χ^2	*df*	*p*
Age	1.66	2	.44	5.81	2	.06	9.33	2	$.01^{**}$	5.57	2	.06	20.69	2	$.00^{***}$	1.12	2	.57
Gender	.49	2	.78	2.39	2	.30	.41	2	.82	2.81	2	.25	1.25	2	.54	0.48	2	.79
Road User Type	25.96	4	$.00^{***}$	2.91	4	.57	5.19	4	.27	7.43	4	.12	5.85	4	.21	9.79	4	$.04^{*}$
Personal Accident	13.00	2	$.00^{***}$	2.07	2	.36	6.26	2	$.04^{*}$	2.26	2	.32	.53	2	.77	2.90	2	.24
Family/Friend Accident	5.48	2	.06	3.44	2	.18	.74	2	.70	4.21	2	.12	2.15	2	.34	2.69	2	.26

Parameter Estimates	Accident Blame	Cause			Blame			ROW- Right Approaching Motorcycle			ROW- Left Approaching Motorcycle			MMA- Motorcycle Overtaking on Approach			MMA-Motorcycle Overtaking Turning Vehicle		
Predictor	Car Driver vs.	B	OR	*p*	B	OR	*p*	B	OR	*p*	B	OR	*p*	B	OR	*p*	B	OR	*p*
Age	Motorcyclist	.01	1.01	.51	.03	1.03	.17	.04	1.04	.30	.03	1.03	.09	.04	1.04	$.00^{***}$	.01	1.0	.87
	Both	−.01	.99	.33	.01	1.01	$.03^{*}$	.03	1.03	$.01^{**}$	.02	1.02	.07	.02	1.02	.08	−.01	.99	.75
Gender	Motorcyclist	−.16	.85	.53	.29	1.34	.73	.19	1.21	.88	.27	1.3	.62	.34	1.4	.29	.09	1.1	.86
	Both	−.18	.83	.67	.34	1.41	.13	.25	1.28	.53	.54	1.72	.09	.32	1.37	.33	−.10	.91	.87
Road User Type																			
Car Driver vs Motorcyclist & Dual	Motorcyclist	.59	1.8	$.03^{*}$	−.68	.51	.54	.06	1.06	.96	.84	2.32	.11	−.68	.51	$.05^{*}$	−1.32	.26	$.01^{**}$
Car Driver vs Motorcyclist & Dual	Both	1.78	5.94	$.00^{***}$	.09	1.1	.71	−.91	.14	.11	−.73	.48	.10	−.28	.75	.40	−.90	.41	.10
Motorcyclist vs. Car Driver & Dual	Motorcyclist	−.53	.59	.10	−.68	0.5	.51	18.77	.00	–	−.80	.45	.45	.15	1.17	.69	−.19	.82	.77
Motorcyclist vs. Car Driver & Dual	Both	−.49	.61	.44	−.34	.71	.18	−.30	.74	.55	−.37	.69	.18	.38	1.46	.31	.30	1.35	.68
Personal Accident	Motorcyclist	−.64	.53	$.00^{***}$	.10	1.11	.86	1.42	4.15	.10	−.34	.71	.47	.165	1.18	.51	−.6	.55	.15
	Both	.40	1.49	.26	−2.4	.79	.17	−53	.59	.09	−.36	.69	.18	.18	1.2	.49	−.38	.69	.40
Family/Friend Accident	Motorcyclist	−.42	.66	$.02^{*}$	−.35	.70	.53	−.06	.94	.94	−.23	.79	.59	−.21	.8	.36	−.53	.59	.21
	Both	−.26	.77	.45	−.29	.75	.07	−.24	.79	.40	−.5	.61	.06	.03	1.03	.90	−.31	.74	.49

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 5
Shows the results for the Chi Squared conducted for the questions regarding reported accidents, vulnerable road users, accident type and purpose of transport. The first Chi-square conducted for each question was the main analysis comparing car drivers' and motorcyclists' responses. The following Chi-squares show the gender split. Each Chi-square shows the percentage for each group, and whether there was a group difference. Below each Chi-square is the probability associated with the test. (Table over 2 pages).

		Car Drivers	Motorcyclists		Male Car Drivers	Female Car Drivers		Male Motorcyclists	Female Motorcyclists		Male Car Drivers Male Motorcyclists	Female Car Drivers Female Motorcyclists
	Full n	102	579		55	47		505	74			
Personal Accident - Have you ever been involved in an accident with another road user that has resulted in injury?	n for question	102	579	681	55	47	102	505	74	579	560	121
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Yes	26.5	37.9	**4.98**	29.1	23.4	.42	40.6	20.3	**11.31**	2.74	.17
	No	73.5	62.1	**.05***	70.9	76.6	.52	59.4	79.7	**.001*****	.10	.68
Family/Friend Own Motorcycle - Does anyone in your immediate family/close friends own a motorcycle?	n for question	102	579	681	55	47	102	505	74	579	560	121
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Yes	45.1	85.9	**89.08**	54.5	34.0	**4.3**	85.7	86.5	.03	**33.71**	**35.29**
	No	54.9	14.1	**.01****	45.5	66.0	**.05***	14.3	13.5	.86	**.001*****	**.001*****
Family/Friend Accident- Have any of your immediate family members/close friends been involved in a motorcycle accident that has resulted in injury?	n for question	102	579	681	55	47	102	505	74	579	560	121
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Yes	40.2	55.9	**8.66**	45.5	34.0	1.37	54.9	63.5	1.97	1.76	**10.00**
	No	59.8	44.1	**.01****	54.5	66.0	.24	45.1	36.5	.16	.18	**.01****
Vulnerable Road User - What mode of transport do you consider to be most vulnerable on the road?	n for question	101	575	676	55	46	101	501	74	575	556	120
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Motorcycle	33.7	42.4	2.73	40.0	26.1	2.17	41.7	47.3	.82	.06	**5.36**
	Bicycle	66.3	57.6	.09	60.0	73.9	.14	58.3	52.7	.37	.81	**.05***
Shared/Competitive- Do you believe the road to be a shared or competitive space with motorcycles?	n for question	102	579	681	55	47	102	505	74	579	560	121
		%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	%	%	**χ^2 (1), *p***	**χ^2 (1), *p***	**χ^2 (1), *p***
	Shared	81.4	42.4	.21	92.7	68.1	**10.15**	81	68.9	**5.72**	**4.68**	.01
	Competitive	18.6	57.6	.65	7.3	31.9	**.001*****	19	31.1	**.05***	**.05***	.92
Accident type- What do you think is the most common accident type for a motorcyclist to be involved in?	n for question	102	579	681	55	47	102	505	74	579	560	121
		%	%	**χ^2 (4), *p***	%	%	**χ^2 (4), *p***	%	%	**χ^2 (4), *p***	**χ^2 (4), *p***	**χ^2 (4), *p***
	Collision while overtaking road users	16.7	8.5	**12.52**	12.7	21.3	6.18	7.5	14.9	**12.75**	8.08	5.11
	Being hit from behind	2.0	1.9	**.05***	0.0	4.3	.19	2.0	1.4	**.05***	.09	.28
	Collisions with right turning vehicles	55.9	58		54.5	57.4		59.2	50.0			
	Collisions with left turning vehicles	10.8	6.4		12.7	8.5		5.3	13.5			
	Loss of control by a motorcyclist	14.7	25.2		20.0	8.5		25.9	20.3			
Transport Purpose- What is your main reason for using a car/ motorcycle?	n for question	98	570	668	52	46	98	496	74	570	548	120
		%	%	**χ^2 (3), *p***	%	%	**χ^2 (3), *p***	%	%	**χ^2 (3), *p***	**χ^2 (3), *p***	**χ^2 (4), *p***
	Commuting	34.7	20.7	**83.66**	38.5	30.4	5.09	20.8	20.3	**23.53**	**52.36**	**16.15**
	As part of your job	11.2	2.6	**.001*****	15.4	6.5	.17	3.0	0.0	**.001*****	**.001*****	**.001*****
	Leisure	28.6	70.9		28.8	28.3		72.2	62.2			
	Personal	25.5	5.8		17.3	34.8		4.0	17.6			

* $p < .05$.
** $p < .01$.
*** $p < .001$.

regards to the chosen psychological processes, cognitive processes reflect how much respondents are actively thinking about the given topic, affective processes refer to the detection of positive and negative emotions (e.g. anxiety, anger, sadness), perceptual processes refer to sensory processes (e.g. seeing, hearing, feeling) and motivational processes refer to the respondents drives and needs (e.g. achievement, reward, risk).

Most variables are expressed as a percentage of the amount of words used in that particular question that fall within a particular category. However, total word count and words per sentence were expressed as an exact number. In cases where there was a significant difference in the language used for motorcyclists and car drivers, the LIWC was used to select quotes from the three respondents who expressed the highest percentage of words that fell within that particular category, to give examples of the most expressive answers given.

3. Results

3.1. Respondents

In total, there were 1813 participants who viewed the questionnaire, with 681 completing the questionnaire. In regards to the analysis, only fully completed responses were included. There were 102 completed car driver responses and 579 completed motorcyclist responses. As can be seen by these figures, the majority of the overall sample were motorcyclist responses. Both of the questionnaires were available to complete for 8 months. A post hoc power analysis was conducted using the software package, G*Power 3.1 (Faul and Erdfelder, 1992). The overall sample size of 681 had more than adequate power (.95) to detect a medium effect (w = .3) with the alpha level used for analysis being $p < .05$.

In regards to the 102 car drivers, there were 47 females (46%) and 55 males (54%). The average age was 39.37 years (SD = 15.38) with an age range of 18–74 years. The sample of car drivers had held a driving licence for between 1 year and 53 + years (Mode = 4–12 years). Their annual mileage also ranged from 0 to 30,000 miles (Mode = 7000-15,000 miles). In terms of recruitment, car drivers were recruited from car driving forums (19.6%, n = 20), through friends or relatives (23.5%, n = 24) and through social media (56.9%, n = 58).

In regards to the 579 motorcyclists, there were 74 females (13%) and 505 males (87%). The average age was 44.73 years (SD = 11.95) with an age range of 17–79 years. The sample of motorcyclists had held a driving licence for between 1 year and 53 + years (Mode = 4–12 years). Their annual mileage also ranged from 0 to 30,000 miles (Mode = 5000–7000 miles). Motorcyclists were recruited from motorcyclist forums (9.3%, n = 54), through friends or relatives (4.3%, n = 24) and through social media (86.4%, n = 501).

As a large proportion of the motorcyclists were male and the car drivers had a fairly equal split of males and females, the analysis could be confounded by gender. It could be possible that any difference between car drivers' and motorcyclists' opinions are due to a gender difference. For this reason, chi-squared tests were conducted for all questions to investigate the gender differences within and between car drivers and motorcyclists, as well as gender being included as a predictor in the multinomial logistical regression models.

All responses to the qualitative questions were initially combined and analysed using the LIWC. It was found that motorcyclists had a significantly higher word count (m = 37.5) compared with car drivers (m = 23.7) (t (679) = 4.17, $p < .001$) and used a greater number of words per sentence (m = 12.56) compared to car drivers (m = 10.30) (t (677) = 2.04, $p < .05$).

3.2. Purpose of transport

As car drivers and motorcyclists were asked to indicate their annual mileage, the median mileage was 7000 miles therefore a chi-square was performed to see if there was a relationship between group and annual mileage, above and below 7000 miles. Car drivers' annual mileage was more likely to be over 7000 miles compared with motorcyclists, and motorcyclists' annual mileage was more likely to be under 7000 miles than car drivers, χ^2 (1) = 36.78, $p < .001$. This may be explained, in part, by the reasons the two groups gave for their main purpose of using a car or a motorcycle.

Car drivers and motorcyclists were asked what the main reason for using their mode of transport was. A chi-square test found a relationship between group and transport purpose, with car drivers more likely to use their car for commuting, as part of their job or personal reasons, whereas motorcyclists were more likely to use their motorcycle for leisure purposes- See Table 5 for results of statistical tests.

In regards to gender, there was a significant difference in male motorcyclists' and female motorcyclists' responses, male car drivers' and male motorcyclists' responses and female car drivers' and female motorcyclists' responses. The former group from these comparisons were more likely to use their motorcycles for commuting, as part of their job and personal reasons, whereas the latter were more likely to use their motorcycles for leisure purposes – See Table 5.

3.3. Blameworthiness of motorcycle crashes

3.3.1. Cause

Both groups were asked "what road user do you think is most likely to cause a motorcyclist to have a road accident?". It was found that car drivers and motorcyclists significantly differed in their responses such that more motorcyclists blamed car drivers. In regards to gender differences, it was found that female car drivers and female motorcyclists significantly differed in their responses- See Table 3 for results of statistical tests.

When asked to explain their choice, there was a significant difference in overall affective language use, with motorcyclists using more affective language (m = 5.5%) than car drivers (m = 3.9%) (t (679) = 2.36, $p < .05$). The three motorcyclists that expressed the most affective language all thought car drivers were likely to cause a motorcyclist to have a crash due to the following reasons, 'Bad Awareness', 'Carelessness' and 'Poor Observation'.

A multinomial logistic regression found that by adding the five key predictors of gender, age, road user type (car drivers, dual road users and motorcyclists), personal accident and family/friend accident to a model that contained only intercept, this significantly improved the fit between the model and the data, $\chi 2(12, N = 681) = 53.26$, Nagelkerke $R2 = .09$, $p < .001$. As shown in Table 4, significant contributions to the model were made by road user type (car drivers vs motorcyclists and dual road users) and personal accident. It was found that car drivers are more likely than motorcyclists and dual road users to blame motorcyclists for the cause of accidents compared to blaming car drivers. In addition, car drivers are more likely than motorcyclists and dual road users to blame both (car driver and motorcyclist) compared to blaming car drivers. In regards to personal accident, respondents who have been involved in a personal accident are less likely to blame motorcyclists compared to car drivers.

3.3.2. Blame

When both groups were asked "who do you think is mostly to blame for car-motorcycle junction accidents?" there was no relationship between group and blame, such that both groups blamed car drivers - See Table 3.

When asked to explain their choice, there was a significant difference in overall use of language associated with cognitive processes, with car drivers (m = 20.65%) using more cognitive language than motorcyclists (m = 16.64%) (t (679) = 2.27, $p < .05$). The three car drivers that expressed the most language associated with cognitive processes all gave different responses on who they believed was mostly to blame for car-motorcycle junction crashes: 'Not paying attention'

(Blamed Car Drivers), 'They can't see clearly' (Blamed Motorcyclists), 'Both need to consider other drivers' (Blamed both Car Drivers and Motorcyclists).

In regards to the multinomial logistic regression, by adding the predictors to a model that contained only intercept, this did not significantly improve the fit between the model and the data, $\chi 2(12, N = 674) = 19.52$, Nagelkerke $R2 = .03$, $p = .07$ – See Table 4 for results of statistical tests.

3.4. Scenarios

3.4.1. ROW- right approaching motorcycle

As can be seen in Table 3, there was no relationship between group and blame for the ROW- right approaching motorcycle scenario, such that both groups blamed car drivers.

When asked to explain their choice for the ROW- right approaching motorcycle scenario, there was a significant difference in overall affective language use, with motorcyclists using more affective language (m = 2.5%) than car drivers (m = 1.5%) (t (679) = 2.23, $p < .05$). The three motorcyclists that expressed the most affective language all thought the car driver was to blame for this crash scenario for the following reasons, 'failure to observe', 'failing to give way' and 'fault? Car driver. Poor defensive tactics… motorcyclist'.

There was also a significant difference in overall use of motivational language, with motorcyclists using more motivational language (m = 3.9%) than car drivers (m = 2.5%) (t (679) = 2.62, $p < .01$). The three motorcyclists that expressed the most motivational language all thought the car driver was to blame for this crash scenario due to 'The law', 'Poor judgment' and 'lack of observation'.

The multinomial regression found that by adding the predictors to a model that contained only intercept, this significantly improved the fit between the model and the data, $\chi 2(12, N = 678) = 23.65$, Nagelkerke $R2 = .06$, $p < .05$. As shown in Table 4, significant contributions were made by age and personal accident to the model. It was found that the more age increases, the more likely respondents are to attribute blame to both car driver and motorcyclists compared to just blaming the car driver.

3.4.2. ROW left approaching motorcycle

For the ROW – left approaching motorcycle scenario, there was also no relationship between group and blame, such that both groups blamed car drivers. In regards to gender differences, male car drivers and male motorcyclists differed in their responses- See Table 3.

When asked to explain their choice for the ROW- left approaching motorcycle scenario, there was a significant difference in overall use of language associated with cognitive processes, with motorcyclists (m = 11.3%) using more than car drivers (m = 8.9%) (t (679) = 2.26, $p < .05$). The three motorcyclists that expressed the most language associated with cognitive processes all thought the car driver was to blame for this crash scenario, for the following reasons 'probably didn't see the motorcycle', 'car driver should make sure the road is clear' and 'lack of observation or impatience'.

The multinomial logistic regression found that by adding the predictors to a model that contained only intercept, this significantly improved the fit between the model and the data, $\chi 2(12, N = 679) = 21.81$, Nagelkerke $R2 = .05$, $p < .05$, however, as shown in Table 4, there were no significant individual contributions made to the model.

3.4.3. MMA- motorcycle overtaking on approach

For the MMA- motorcycle overtaking on the approach scenario, it was found that car drivers and motorcyclists significantly differed in their responses, such that more motorcyclists blamed motorcyclists. In regards to gender differences, female car drivers and female motorcyclists significantly differed in their responses- See Table 3.

When asked to explain their choice for the MMA- motorcycle overtaking on the approach scenario, there was a significant difference in overall affective language use, with motorcyclists using more affective language (m = 4.1%) than car drivers (m = 2.5%) (t (679) = 2.33, $p < .05$). The three motorcyclists that expressed the most affective language all thought the motorcyclist was to blame for this crash scenario due to the following reasons, 'Dangerous overtake', 'Unsafe overtake' and 'Poor defensive skills by biker, easily avoided'.

The multinomial regression found that adding the predictors to a model that contained only intercept, this significantly improved the fit between the model and the data, $\chi 2(12, N = 675) = 34.91$, Nagelkerke $R2 = .06$, $p < .001$, with a significant contribution made by age to the model- See Table 4. It was found that as age increases, respondents are more likely to attribute blame to the motorcyclist compared to the car driver.

3.4.4. MMA- motorcycle overtaking turning vehicle

In the MMA- motorcycle overtaking turning vehicle scenario, car drivers and motorcyclists significantly differed in their responses, although both groups blamed motorcyclists. In regards to gender, female car drivers and female motorcyclists significantly differed in their responses- see Table 3.

The multinomial logistic regression found that by adding the predictors to a model that contained only intercept, this significantly improved the fit between the model and the data, $\chi 2(12, N = 676) = 20.54$, Nagelkerke $R2 = .04$, $p < .05$, with a significant contribution made by road user type (Car driver vs Motorcyclists and Dual Road Users) to the model. It was found that car drivers are less likely than motorcyclists and dual road users to blame the motorcyclist compared to blaming the car driver.

3.5. General vs. specific

As seen previously, when both groups were asked in a general abstract sense "what road user do you think is most likely to cause a motorcyclist to have a road accident?", car drivers and motorcyclists significantly differed in their responses, with motorcyclists more likely to blame car drivers- see Fig. 2a.

Over the four specific scenarios, the amount of times each respondent blamed the car driver, motorcyclist and other ('both car driver and motorcyclist' or 'neither') was calculated. Independent samples t-tests were conducted, comparing car drivers' and motorcyclists' attribution of blame summed across all four specific scenarios. It found that car drivers were significantly more likely to blame car drivers in specific situations compared to motorcyclists (t (679) = 2.56, $p < .05$), and motorcyclists were significantly more likely to blame motorcyclists in specific situations compared to car drivers (t (679) = 1.99, $p < .05$). In regards to the 'other' responses, there was no significant difference in these responses between car drivers and motorcyclists [t (679) = .51, $p = .61$]- see Fig. 2b.

3.6. Reported accidents

As can be seen in Table 5, motorcyclists and car drivers significantly differed in their responses- in regards to whether they have been involved in an accident that has resulted in injury. In regards to gender, there was a significant difference in male motorcyclists' and female motorcyclists' responses in regards to whether they have had an accident- see Table 5.

In regards to family/friend accidents, motorcyclists were also more likely to have a family member/friend who has been involved in a motorcycle accident (55.9%) compared to car drivers (40.2%). In regards to gender, there was a significant difference in responses made by female car drivers and female motorcyclists, with female motorcyclists more likely to have a family member/friend who has been involved in a motorcycle accident (63.5%) compared to female car drivers (34%)- See Table 5.

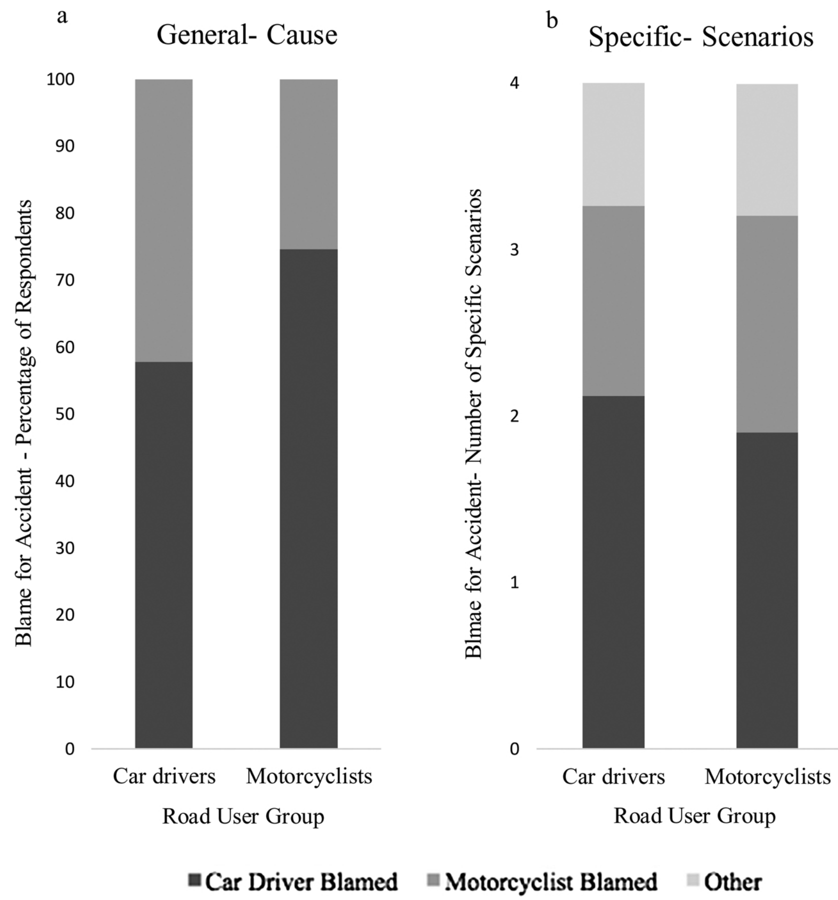

Fig. 2. Fig. 2a shows the difference in car drivers' and motorcyclists' responses when asked in a general abstract sense what road is most likely to cause a motorcycle to have an accident. Fig. 2b shows the mean number of times car drivers and motorcyclists blamed each road user type across all four specific scenarios.

3.7. Family/friend own motorcycle

In regards to owning a motorcycle, motorcyclists and car drivers differed significantly in their responses, with motorcyclists more likely to have immediate family/close friends who owned a motorcycle (85.9%) compared to car drivers (45.1%)- See Table 5.

In regards to gender differences, there was a significant difference in responses made by male car drivers and female car drivers, female motorcyclists and female car drivers and male car drivers and male motorcyclists. The former group from these comparisons were more likely to have immediate family/close friends who owned a motorcycle compared to the latter – See Table 5.

3.8. Sharing the Road

It was found that there was no relationship between group and choosing who they consider to be the most vulnerable road user, and whether the road is a shared or competitive space – See Table 5.

In regards vulnerable road users, there was a significant difference in female car drivers' and female motorcyclists' responses- see Table 5.

In regards shared/competitive space, there was a significant difference in male car drivers' and female car drivers' responses, male motorcyclists' and female motorcyclists' responses and male car drivers' and male motorcyclists' responses- see Table 5.

Respondents were asked what they think is the most common accident type for a motorcyclist to be involved in. Car drivers were more likely choose motorcyclists overtaking other vehicles or collisions with left turning vehicles, whereas motorcyclists were more likely to choose collisions with right turning vehicles or a loss of control by the motorcyclist- see Table 5. When asked to explain their choice regarding the most common accident, car drivers had a significantly higher word count (m = 14.9) compared with motorcyclists (m = 13.0) (t (679) = 1.96, $p < .05$).

In regards to gender, there was a significant difference in male motorcyclists' and female motorcyclists' responses- see Table 5. Female motorcyclists were more likely choose motorcyclists overtaking other vehicles or collisions with left turning vehicles, whereas male motorcyclists were more likely to choose collisions with right turning vehicles or a loss of control by the motorcyclist.

4. Discussion

The results indicate that when comparing car drivers' and motorcycles' opinions towards the same road situations, their opinions change depending on how specific the situation is. When asked in a general abstract sense which road user is most likely to cause a motorcyclist to have a road accident, car drivers' and motorcyclists' responses significantly differed, with motorcyclists particularly likely to blame car drivers, demonstrating an in-group bias. However, when asked who they believe is to blame for a specific car-motorcycle crash at a junction, this in-group bias is no longer present - both groups tend to blame the car driver and there is no evidence of car drivers tending to blame motorcyclists more. This is a striking and rather unexpected finding – particularly given that when specific details about the car-motorcycle junction crash are subsequently provided, attributions of blame become much more varied.

This reduction of in-group bias is notable in the scenario questions, where it appears repeatedly across examples, especially in the MMA scenarios, with motorcyclists more likely to blame the motorcyclist. This reduction in in-group bias was also displayed with car drivers, however, the smaller sample size means that the effect is not statistically significant. When looking at all four specific scenarios together, this reversal in in-group favouritism was also seen, with car drivers being more likely to blame the car driver and motorcyclists being more likely to blame the motorcyclist. This was also true when drivers were spilt into three road user categories for the multinomial logistic regressions, as drivers with any motorcycle experience were less likely to blame motorcyclists for the cause of general crashes compared to car drivers however, this in-group bias reduced in the specific MMA scenarios, as they were more likely than car drivers to blame motorcyclists.

These findings support the well-established finding that attitudes are variable and context-dependent (Turner, 1985). As hypothesised, specificity had an effect on road users' opinions about blame in differing situations, with specific situational detail mitigating the in-group bias which was displayed by these road users when asked generally about motorcycle accidents. In light of this, it could be the case that due to the context and frame of judgement being more specific in the scenarios in terms of the situation and location of the vehicles involved, this changes the road users' opinions compared to when asked generally about motorcycle accidents. These specific scenarios are arguably more like a real-world situation.

In regards to the ROW scenarios, there seems to be agreement from both car drivers and motorcyclists, that the car driver would be at blame in these situations. Substantial research investigating real life junction ROW accidents has found that in a high proportion of these situations, police records show the main contributory factor to be 'fail to give way (or yield)' (Lynam et al., 2001). This suggests that both road user groups were sensitive to the fact that motorcyclists, by law, have right of way in this instance and have answered in agreement to this. In addition, given that motorcyclists believed these crashes occur due to perceptual reasons, in terms of the car driver failing to observe or see the approaching motorcycle, this suggests that motorcyclists are also sensitive to the notion of 'Look But Fail To See' (LBFTS) errors, inferring that this crash could be caused by the lack of observation by the car driver. Although these scenarios only included a single motorcycle, perceptual errors have been seen to be apparent when both single vehicles and multiple vehicles are approaching the junction (Labbett and Langham, 2006; Crundall et al., 2012).

These findings therefore suggest that as the situation surrounding the junction crash becomes more specific, this elicits a fairer evaluation of blame from both road user types, reducing their in-group favouritism compared to when asked about the cause of motorcycle accidents in an abstract sense. Due to the reduction in in-group bias in specific situations, it could be the case that negative attitudes towards the other road user are no longer influencing behavioural decisions made at a junction. This suggests that these crashes may not be a result of a violation, as negative attitudes have been seen to heavily contribute to violations (Mesken et al., 2002), but possibly due to an error that is less influenced by attitudes. Although these specific scenarios were more comparable to real life situations compared to previous questions, it must be highlighted that in reality, it may nonetheless be the case that a poor attitude may affect drivers' visual attention at a junction, as gap acceptance is a quick and dynamic behaviour, therefore all situational information may not be taken into account.

In both the right turn and overtaking scenarios, a lack of motorcyclist defensive skills was highlighted in both cases by motorcyclist respondents. Motorcyclists' defensive skills are those that allow the rider to behave quickly and efficiently in difficult circumstances. It seems to be the case that in situations where the car driver or motorcyclist is seen to be at fault, motorcyclists expect to use defensive techniques, whether this be to anticipate the mistake of the car driver in order to protect themselves, or use these skills in order to make a decision about safe overtakes. Although defensive skill training has been seen to reduce motorcycle accidents (McDavid et al., 1989), it should not be the case that motorcyclists alone have to anticipate the behaviour of another road user in order to feel safe on the road or make themselves known. As the LIWC highlighted in both road user groups' responses throughout the questionnaire, the visual attention of both road users at intersections is extremely important and should be a target of investigation, in particular car drivers' visual attention. Previous research has found that drivers' visual attention at intersections towards oncoming motorcycles is not always sufficient (Crundall et al., 2008a, 2012; Lee et al., 2015), which may be partly due to a difficulty in judging motorcyclists' speeds (Horswill and Helman, 2003), particularity as motorcycles spend a much greater proportion of time travelling at higher speeds (DfT, 2015b).

When respondents were asked about the most common accident type, car drivers were more likely to choose motorcyclists overtaking other vehicles, and motorcyclists were more likely to choose motorcyclists losing control. These choices are understandable given that cars are usually the vehicles which are being overtaken by motorcycles, therefore this crash would be more noticeable to this road user group. Similarly, when motorcyclists lose control of their bike, this situation only involves a motorcyclist, therefore car drivers will not be aware of how common these crashes are. Motorcyclists were also more likely to choose vehicles turning right - given that accident statistics show that right turns are responsible for around 70% of all crashes at junctions in the U.K. (Transport Department, 1994), it may be the case that motorcyclists have encountered more unsafe experiences with car drivers turning right, compared to car drivers turning left at junctions.

When investigating the purpose of transport, the differences in car drivers' and motorcyclists' responses suggest that our car driver respondents used their vehicle for more practical purposes such as commuting, whereas the motorcyclists use their motorcycle more for leisure purposes. This, in part, may explain why the car drivers had a generally higher annual mileage compared to motorcyclists. Previous studies which have investigated the key determinants of motorcyclists' riding behaviour, indicated that motorcycle riding is predominately a social activity, often occurring within groups (Watson et al., 2007). Motorcyclists reasons for why and how they ride have also been seen to be related to the social context of riding including self-identity (Tunnicliff et al., 2011). Findings from car driver interviews, however, have found that drivers mainly use a car for reasons of flexibility and freedom, minimising the amount of time and effort needed to reach a destination (Kent, 2014).

In regards to the responses made to the questionnaires, there were notably more motorcyclist responses compared to car driver responses. As the recruitment strategy was similar for both questionnaires, the large difference in responses is striking. It seems to reflect the fact that motorcyclists are far more likely to want to express their opinions on car-motorcycle crashes, than car drivers are. In addition, when actually completing the questionnaire motorcyclists also had an overall higher word count and greater number of words per sentence compared to car drivers, which has been seen to reflect an increase in cognitive complexity (Arguello et al., 2006). This may suggest that motorcyclists have stronger opinions about junction crashes and are more engaged in the given questionnaire. It also must be noted that the recruitment strategy may have had an effect on the responses required, as forum users may be more passionate about their motorcycle/car, or road safety. That said, forum users only made up a small percentage of the overall respondent sample, and there is no reason to believe that these findings would not be true for other road users (Delbosc and Currie, 2014).

In addition, although there were roughly equal male and female car driver respondents, there were significantly more males (87%) than females (13%) in the motorcyclist sample, suggesting that vehicle use is confounded with gender. However, these gender splits accord well with previous research which has found that men are seven times more likely to make a motorcycle trip than women (Clarke et al., 2004) and car driver estimates show there were 53% male and 47% female car drivers in the U.K. in 2016 (DfT, 2017). Therefore, although there may be gender confounds in the opinions reported by car drivers and motorcyclists, separating these effects out will never be completely satisfactory.

The fact that motorcyclists reported being involved in more injury related crashes compared to car drivers is consistent with the crash statistics described previously (DfT, 2015a,b). This may also partially explain their higher engagement in the questionnaire compared with car drivers, as more direct behavioural experiences have been seen to increase the strength and accessibility of attitudes towards a given situation (Fazio et al., 1982). It is also expected that as motorcyclists are vulnerable road users, they have a heightened awareness of the dangers associated with intersections compared to car drivers, and therefore may have more to discuss when asked about this given topic. In addition, the fact that drivers who had reported a personal accident were less likely to blame motorcyclists than car drivers, again suggests that as ROW accidents account for 70% of all crashes at junctions in the U.K., respondents may be drawing upon their direct behavioural experiences when attributing blame.

The primary road safety implications of these research findings are around the framing and acceptability of road interventions. Previous research studies have found that both car drivers (39.48%) and motorcyclists (40.42%) are equally likely to have undertaken advanced driver/rider training (Horswill and Helman, 2003), which is reflected in the current sample (Car drivers– 29.41%, Motorcyclists– 29.36%). This suggests that both road users are willing to improve their safety related skills and defensive skills on the road. Given that car drivers' and motorcyclists' opinions were collected in regards to accident blame, these opinions are important in the engagement of safety interventions. An example of this could be exposing new car drivers to more on-road motorcycle interactions where car drivers are likely to accept blame, i.e. ROW crashes, touching upon existing educational campaigns such as 'Think! Bike', as it is more likely these road users will engage in safety related interventions in these specific situations. Conversely, by exposing motorcyclists to situations where motorcyclists are likely to accept blame, i.e. MMA crashes, this may increase their willingness to expand their knowledge and skills when manoeuvring around other vehicles on the approach to a junction.

Future research should consider investigating car drivers' and motorcyclists' crash history in more depth, by distinguishing how recent the crash was and under what circumstances it happened, as this additional information may provide new insights on blame attribution. In addition, a qualitative thematic analysis of car drivers' and motorcyclists' responses could also be considered, to see if additional themes emerge beyond those seen in the current study.

5. Conclusions

In summary, when comparing the opinions of car drivers and motorcyclists towards junction crashes, their responses in relation to who they believe is blameworthy is dependent on how specific the situation is which is presented. When respondents were asked, who is the main cause of motorcycle crashes in an abstract sense, motorcyclists were more likely to blame car drivers, demonstrating an in-group bias. However, when presented with specific scenarios, this in-group favouritism is reduced or reversed. In typical ROW crashes, the law is taken into account, as well as a large emphasis on the lack of observation given around junctions, especially from car drivers. We conclude that road users may show in-group biases when their general opinions are measured, but that their attribution of blame in crashes is very much dependent on the precise nature of the crash. Providing road users with details of very specific crash situations is likely to elicit a fairer evaluation of blame in both motorcyclists and car drivers and could represent a useful strategy for future road safety interventions. Future road safety interventions should focus on the framing and acceptability of interventions, as road users' opinions on blame attribution will largely influence their engagement in such interventions.

Conflicts of interest

None.

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References

ACEM, 2009. Association des Constructeurs Europeens de Motocycles MAIDS In-Depth Investigations of Accidents Involving Powered Two Wheelers. ACEM, Brussels (2008) (Final Report 2.0).
Ajzen, I., Fishbein, M., 1975. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.
Arguello, J., Butler, B.S., Joyce, E., Kraut, R., Ling, K.S., Rosé, C., Wang, X., 2006. Talk to me: foundations for successful individual-group interactions in online communities. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, pp. 959–968.
Augoustinos, M., Walker, I., 1995. Social Cognition: An Integrated Introduction. Sage Publications, London.
Bergman, M.M., 1998. A theoretical note on the differences between attitudes, opinions, and values. Swiss Polit. Sci. Rev. 4 (2), 81–93.
Brown, I.D., 2002. A Review of the 'Look But Failed to See'Accident Causation Factor. Behavioural Research in Road Safety XI. Department of Transport, Local Government and the Regions, London, UK.
Brooks, P., Guppy, A., 1990. Driver awareness and motorcycle accidents. Proc. Int. Motorcycle Saf. Conf. 2 (10), 27–56.
Christmas, S., Young, D., Cookson, R., Cuerden, R., 2009. Passion, Performance, Practicality-motorcyclists' Motivations and Attitudes to Safety-Motorcycle Safety Research Project.
Clarke, D.D., Ward, P., Bartle, C., Truman, W., 2004. In-depth Study of Motorcycle Accidents. Retrieved from:. Department for Transport, London, UK. http://speedcamerareport.co.uk/dft_motorcycle_accidents.pdf.
Clarke, D.D., Ward, P., Bartle, C., Truman, W., 2007. The role of motorcyclist and other driver behaviour in two types of serious accident in the UK. Accid. Anal. Prev. 39 (5), 974–981.
Cohn, M.A., Mehl, M.R., Pennebaker, J.W., 2004. Linguistic markers of psychological change surrounding September 11, 2001. Psychol. Sci. 15 (10), 687–693. http://dx.doi.org/10.1111/j.0956-7976.2004.00741.x.
Crundall, D., Bibby, P., Clarke, D., Ward, P., Bartle, C., 2008c. Car drivers' attitudes towards motorcyclists: a survey. Accid. Anal. Prev. 40 (3), 983–993.
Crundall, D., Clarke, D., Ward, P., Bartle, C., 2008b. Car drivers' skills and attitudes to motorcycle safety: a review. Road Safety Research Report.
Crundall, D., Crundall, E., Clarke, D., Shahar, A., 2012. Why do car drivers fail to give way to motorcycles at t-junctions? Accid. Anal. Prev. 44 (1), 88–96.
Crundall, D., Humphrey, K., Clarke, D., 2008a. Perception and appraisal of approaching motorcycles at junctions. Transp. Res. Part. F 11 (3), 159–167.
Delbosc, A., Currie, G., 2014. Using discussion forums to explore attitudes toward cars and licensing among young Australians. Transp. Policy 31, 27–34.
Department of Transport, 2017. Driving Licence Holding and Vehicle Availability (NTS02). Retrieved from:. https://www.gov.uk/government/statistical-data-sets/nts02-driving-licence-holders.
Department of Transport, 2015a. Reported Road Casualties Great Britain: Annual Report 2015. Retrieved from:. . https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/556396/rrcgb2015-01.pdf.
Department of Transport, 2015b. Free Flow Vehicle Speeds in Great Britain: 2015. Retrieved from:. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/533244/free-flow-vehicle-speeds-great-britain-2015.pdf.
Eid, J., Johnsen, B.H., SAUS, E.R., 2005. Trauma narratives and emotional processing. Scand. J. Psychol. 46 (6), 503–510.
Faul, F., Erdfelder, E., 1992. GPOWER: A priori, Post-hoc, and Compromise Power Analyses for MS-DOS [Computer Program]. FRG: Bonn University, Department of Psychology, Bonn.
Fazio, R.H., Chen, J.M., McDonel, E.C., Sherman, S.J., 1982. Attitude accessibility, attitude-behavior consistency, and the strength of the object-evaluation association. J. Exp. Soc. Psychol. 18 (4), 339–357.
Glasman, L.R., Albarracín, D., 2006. Forming attitudes that predict future behavior: a meta-analysis of the attitude-behavior relation. Psychol. Bull. 132 (5), 778.
Haslam, S.A., Turner, J.C., Oakes, P.J., McGarty, C., Hayes, B.K., 1992. Context-dependent variation in social stereotyping 1: the effects of intergroup relations as mediated by social change and frame of reference. Eur. J. Soc. Psychol. 22 (1), 3–20.
Hole, G., Langham, M., 1997. Reaction Time. Biannual Conference of the Institute of Traffic Accident Investigators, Telford.
Horswill, M.S., Helman, S., 2003. A behavioral comparison between motorcyclists and a matched group of non-motorcycling car drivers: factors influencing accident risk. Accid. Anal. Prev. 35 (4), 589–597.
Hurt, H.H., Ouellet, J.V., Thom, D.R., 1981. Motorcycle Accident Cause Factors and Identification of Countermeasures, vol. 2 The Administration.

Hsu, T.P., Sadullah, E.A.F.M., Dao, I.N.X., 2003. A Comparison Study on Motorcycle Traffic Development in Some Asian Countries — Case of Taiwan, Malaysia and Vietnam.
Jost, J.T., Major, B. (Eds.), 2001. The Psychology of Legitimacy: Emerging Perspectives on Ideology, Justice, and Intergroup Relations. Cambridge University Press.
Kent, J.L., 2014. Driving to save time or saving time to drive? The enduring appeal of the private car. Transp. Res. Part. A 65, 103–115.
Keskinen, E., Ota, H., Katila, A., 1998. Older drivers fail in intersections: speed discrepancies between older and younger male drivers. Accid. Anal. Prev. 30 (3), 323–330.
Labbett, S., Langham, M., 2006. What do drivers do at junctions. 71st RoSPA Road Safety Congress, Blackpool.
Lee, Y.M., Sheppard, E., Crundall, D., 2015. Cross-cultural effects on the perception and appraisal of approaching motorcycles at junctions. Transp. Res. Part. F 31, 77–86.
Lynam, D., Broughton, J., Minion, R., Tunbridge, R.J., 2001. An Analysis of Police Reports of Fatal Accidents Involving Motorcycles (No. TRL Report 492).
McDavid, J.C., Lohrmann, B.A., Lohrmann, G., 1989. Does motorcycle training reduce accidents? Evidence from a longitudinal quasi-experimental study. J. Saf. Res. 20 (2), 61–72.
Mesken, J., Lajunen, T., Summala, H., 2002. Interpersonal violations, speeding violations and their relation to accident involvement in Finland. Ergonomics 45 (7), 469–483.
Mitsopoulos-Rubens, E., Lenné, M.G., 2012. Issues in motorcycle sensory and cognitive conspicuity: the impact of motorcycle low-beam headlights and riding experience on drivers' decisions to turn across the path of a motorcycle. Accid. Anal. Prev. 49, 86–95.
Musselwhite, C., Avineri, E., Fulcher, E., Goodwin, P., Susilo, Y., 2010. Understanding the public attitudes to road safety. A Review of the Literature 2000–2009.
Musselwhite, C.B., Avineri, E., Susilo, Y.O., Bhattachary, D., 2012. Public attitudes towards motorcyclists' safety: a qualitative study from the United Kingdom. Accid. Anal. Prev. 49, 105–113.
O'Connell, M., 2002. Social psychological principles: 'the group inside the person'. Human Factors for Highway Engineers.
Parker, D., Reason, J.T., Manstead, A.S.R., Stradling, S.G., 1995. Driving errors, driving violations and accident involvement. Ergonomics 38 (5), 1036–1048.
Pennebaker, J.W., Boyd, R.L., Jordan, K., Blackburn, K., 2015. The Development and Psychometric Properties of LIWC2015. University of Texas at Austin, Austin TX.
Ratner, K.G., Dotsch, R., Wigboldus, D.H., van Knippenberg, A., Amodio, D.M., 2014. Visualizing minimal ingroup and outgroup faces: implications for impressions, attitudes, and behavior. J. Pers. Soc. Psychol. 106 (6), 897.
Shahar, A., Clarke, D., Crundall, D., 2011. Applying the motorcyclist's perspective to improve car drivers' attitudes towards motorcyclists. Accid. Anal. Prev. 43 (5), 1743–1750.
Shinar, D., 2012. Safety and Mobility of Vulnerable Road Users: Pedestrians, Bicyclists, and Motorcyclists.
Tausczik, Y.R., Pennebaker, J.W., 2010. The psychological meaning of words: LIWC and computerized text analysis methods. J. Lang. Soc. Psychol. 29 (1), 24–54. http://dx.doi.org/10.1177/0261927x09351676.
Tunnicliff, D., Watson, B., White, K.M., Lewis, I., Wishart, D., 2011. The social context of motorcycle riding and the key determinants influencing rider behavior: a qualitative investigation. Traffic Inj. Prev. 12 (4), 363–376.
Transport Department, 1994. Design Manual for Roads and Bridges - Layout of Compact Grade Separated Junctions, London.
Turner, J.M., 1985. Brown into black: changing racial attitudes of Afro-Brazilian university students. Race, Class and Power in Brazil. pp. 73–94.
Walker, G.H., Stanton, N.A., Salmon, P.M., 2011. Cognitive compatibility of motorcyclists and car drivers. Accid. Anal. Prev. 43 (3), 878–888.
Watson, B.C., Tunnicliff, D.J., White, K.M., Schonfeld, C.C., Wishart, D.E., 2007. Psychological and Social Factors Influencing, Motorcycle Rider Intentions and Behaviour.
Wong, J.T., Chung, Y.S., Huang, S.H., 2010. Determinants behind young motorcyclists' risky riding behavior. Accid. Anal. Prev. 42 (1), 275–281.